



Autoridad de
Energía Eléctrica

COR
CENTRAL OFFICE FOR
RECOVERY, RECONSTRUCTION AND RESILIENCY

The Grid Modernization of Puerto Rico

Transforming and Upgrading the Energy Sector





Background: The Puerto Rican Grid

Recovery presents an opportunity to transform the electrical grid of Puerto Rico by implementing solutions that are **customer-centric**, **resilient**, and **sustainable**.

WHERE WE WERE ?

Hurricane Maria caused the longest power outage in U.S. history – leaving parts of Puerto Rico without electricity for **328 days**. The damage from the Hurricanes of 2017 was exacerbated by decades of underinvestment and deficient maintenance of critical infrastructure.



3.4 million

Residents lost power immediately¹



328 days

84 days on average, until power was restored to residents²



25%

Of transmission line towers destroyed³

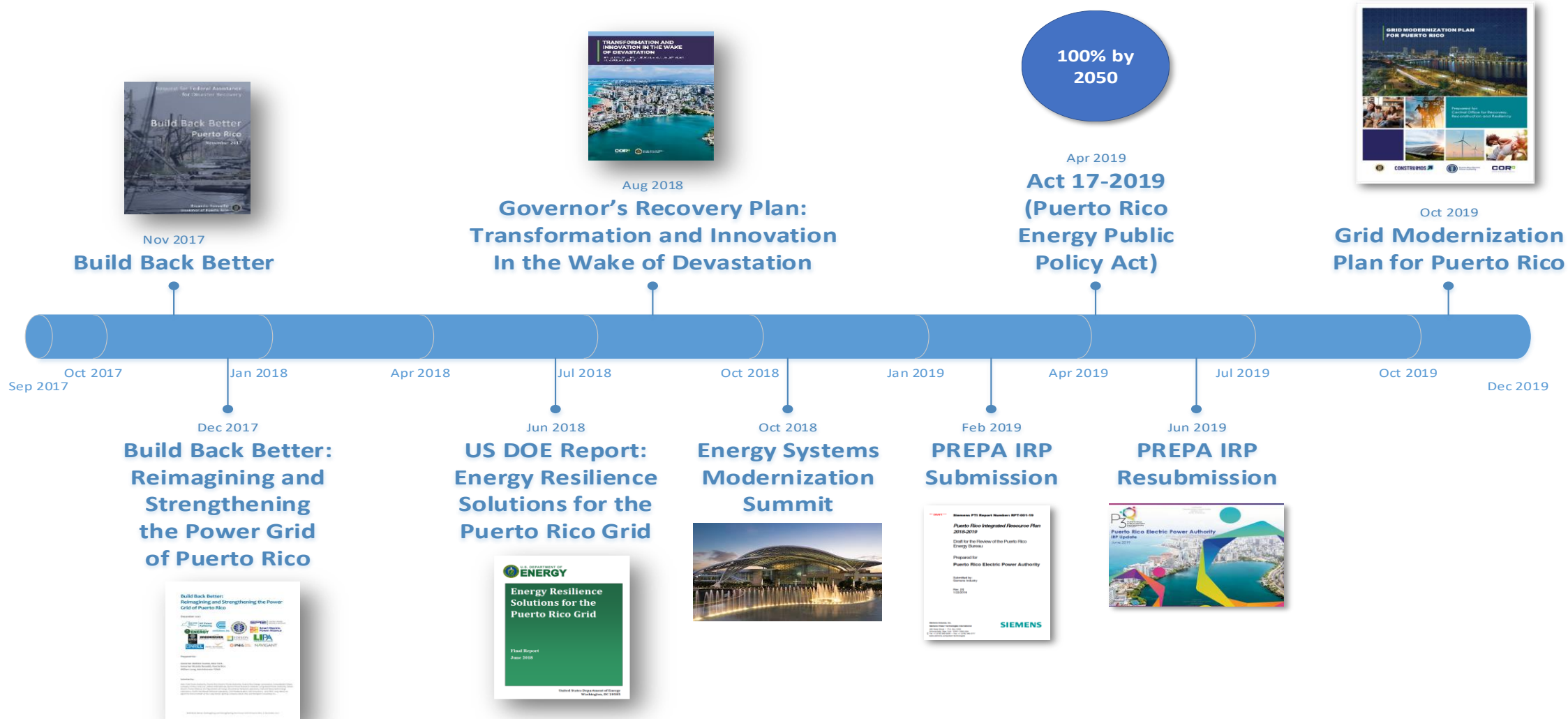
WHERE WE ARE GOING ?

The Electrical Grid Modernization (GridMod) Plan will rebuild damaged facilities to higher standards, improve quality of life, and increase reliability in energy services. The GridMod Plan will result in a decentralized and flexible grid that will be **affordable to maintain**, lead to **reduced costs for consumers**, and provide **greener and more sustainable solutions**.

¹ <https://www.cnn.com/2018/08/14/us/puerto-rico-power-restored/index.html>

² <https://www.forbes.com/sites/pikersearch/2019/03/18/is-puerto-rico-providing-a-blueprint-to-reinvent-the-overall-us-power-grid/#2e7c108613d7>

³ https://recovery.pr/tbackend_prod/api/document/download/566 (page 41)



Goals: The GridMod Plan

A **customer-centric**, **resilient**, and **sustainable** electrical grid is key to the economic growth of Puerto Rico. The GridMod Plan is guided by 3 basic principles to “Build Back Better” from the devastation of the 2017 Hurricanes.



Customer-Centric

- Improve affordability for residents and businesses
- Transform the customer service system and increase customer engagement with the utility
- Allow users to both produce and consume energy



Resilient

- Reinforce the electrical grid to withstand future extreme weather
- Invest in emergency preparedness
- Decentralize the grid to reduce and isolate outages
- Increase capacity to meet peak demand



Sustainable

- Develop an energy ecosystem that spurs job and business growth, improving stability for utilities, the energy sector, and the overall economy
- Increase the use of Liquefied Natural Gas (LNG) to transition away from legacy fossil fuels
- Position Puerto Rico as a leader in green energy for the United States with a vision of 100% renewable generation by 2050

Deep-Dive: Customer-Centricity

The GridMod plan is designed to prioritize and empower the residents and businesses of Puerto Rico by providing affordable, flexible, and efficient energy solutions.

The GridMod Plan provides the following benefits to customers:

Affordability

- **Decrease overall operating costs to customers and the Government of Puerto Rico.** With a system that is more reliable, affordable, and easier to maintain



Flexibility

- **Increase the number of options for electricity.** A mix of sources will be available through gradual transition from traditional to renewable
- **Modernize customer systems for customers to best address their energy needs** and increase overall customer engagement
- **Opportunity to become prosumers,** consuming power as needed and contributing excess energy back into the grid through use of renewables



Efficiency

- **Increase LNG generation.** LNG is 50% more efficient than older, oil-fired generation and significantly reduces emissions
- **Implement a smarter grid** that will use advanced analytics to distribute energy where and when it is needed most
- **Use smart meters** and advanced software to reduce theft & billing errors while reducing cost.

Deep-Dive: Resilient

Through a focus on infrastructure, technology, and capacity for clean energy – the GridMod Plan will enable the Puerto Rican energy grid to be more resilient to the potential impacts of weather and cyber threats, and it will posture the electrical grid to more quickly return to service in the event of future disasters.



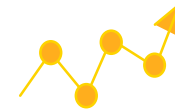
Hardening the grid

- **Repair and harden infrastructure** to better withstand weather events
- **Reinforce substations** to withstand flooding and high-winds
- **Establish a Management Program** to oversee maintenance
- **Install mitigation technology**, such as automated switching devices and microprocessor relays



Reducing vulnerabilities

- **Decentralize the grid** with 8 Islandable Microgrids and Distributed Energy Resource technology
- **Secure the grid** with modern cybersecurity systems and physical security measures
- **Underground** lines that are high-risk or serve critical loads
- **Distribute response facilities** in geographically dispersed areas



Optimizing Capacity

- **Focus on LNG** over legacy fuels that are more costly, inefficient, and toxic to the environment
- **Prepare grid** to support increased use of solar, battery, and LNG
- **Reduce restoration** time and costs with modernized infrastructure

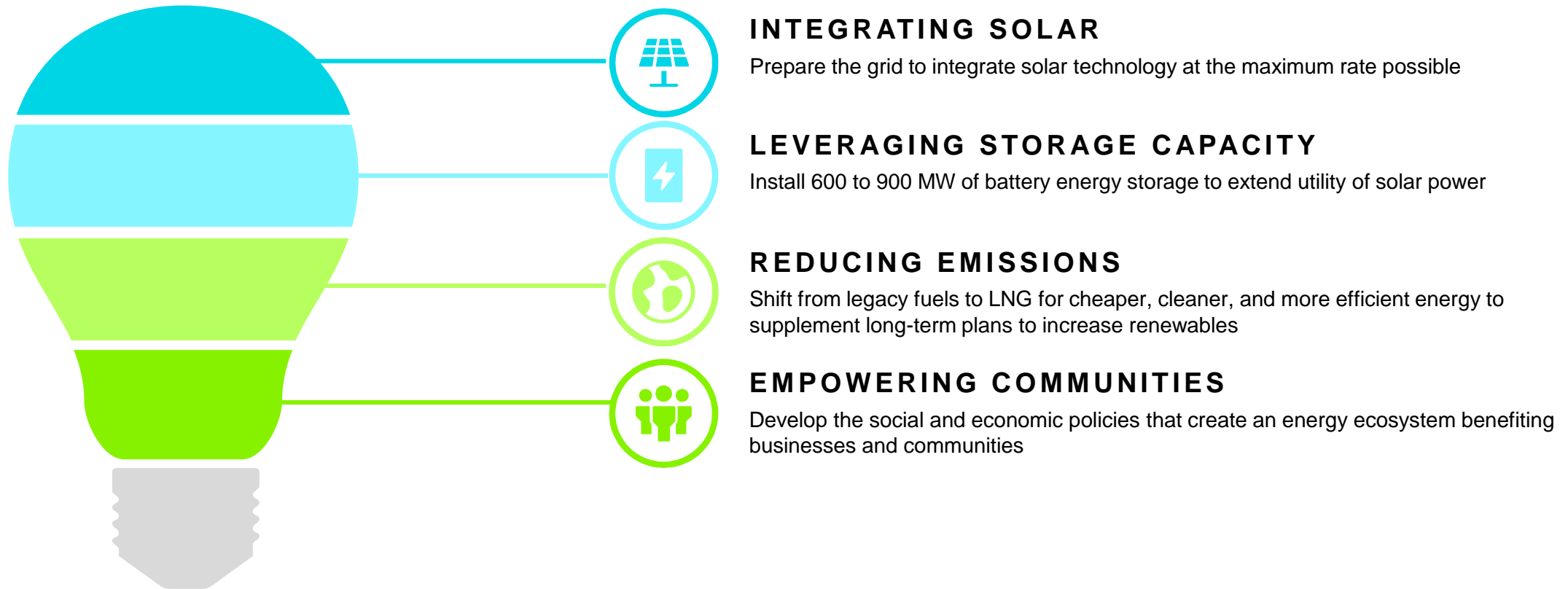


Smartening the Grid

- **Upgrade control systems** with smart grid diagnostic centers and digital sensors
- **Pilot emerging technology** at the Technology & Innovation Center
- **Streamline operations** with systems integration and automation of services
- **Leverage information systems** with IT geospatial capabilities and advanced monitoring solutions

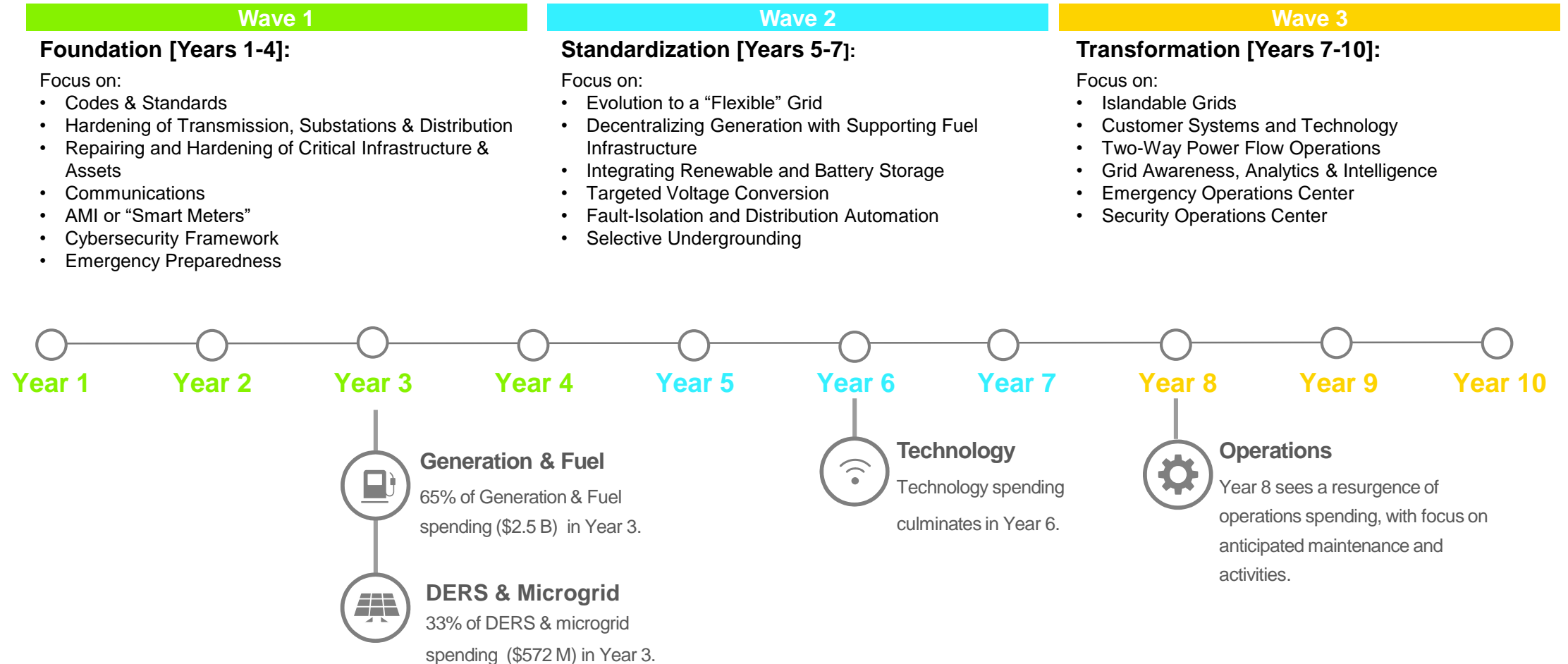
Deep-Dive: Sustainable

The GridMod Plan promotes sustainable development and combats climate change by preparing the electrical grid to integrate renewables, change the fuel mix, and develop a power grid that can be maintained in the long-term.



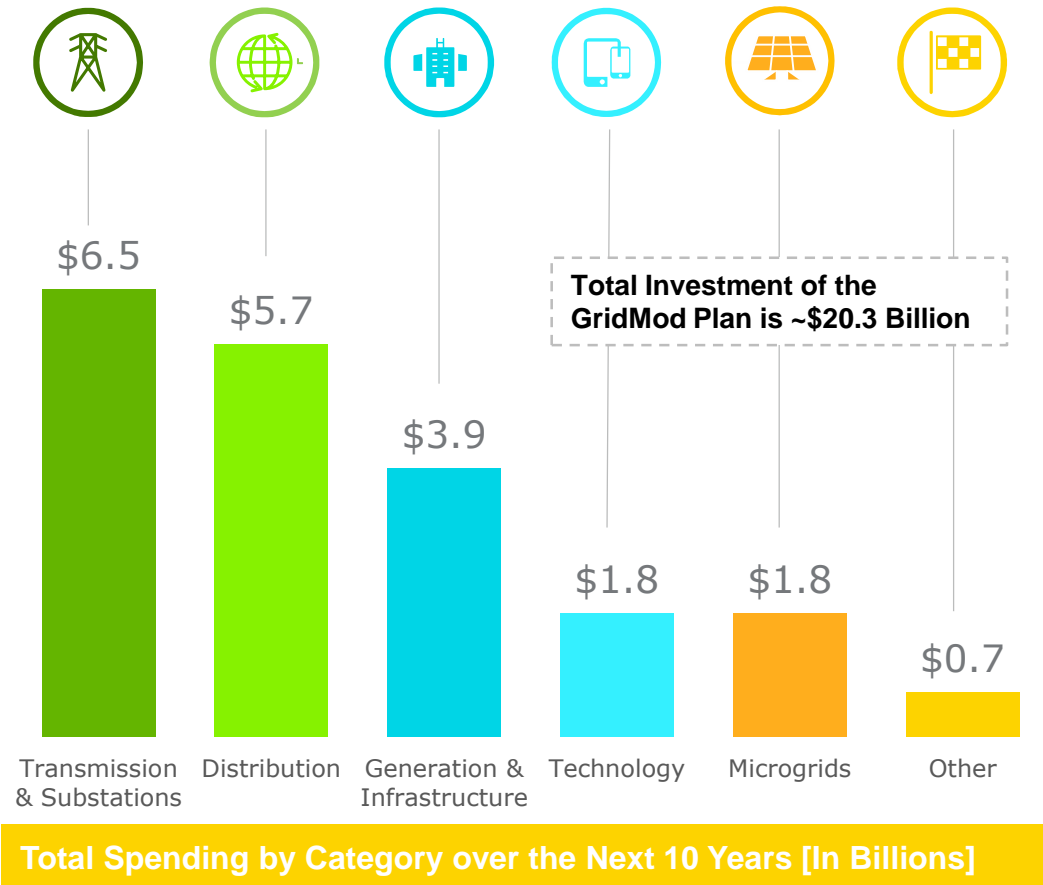
Roll-out Timeline

The GridMod Plan will be implemented in three phases over the subsequent 10-years. While 10-years is an aggressive timeline – it is critical to rebuild quickly to prepare the island with a resilient grid in the event of future disasters.



Cost Breakdown by Category

The costs associated with the GridMod Plan are distributed across 6 categories and total an investment strategy of \$20.3 billion.



1 Transmission & Substations

Harden the transmission grid; reinforce or relocate existing high and medium voltage substations

2 Distribution

Strengthen poles and lines to reduce outages; relocate equipment; automate and relocate inaccessible lines

3 Generation & Infrastructure

Increase clean energy; reinforce current generation plants; improve reliability

4 Technology

Automate grid capabilities; upgrade customer systems

5 Microgrids

Add value and reduce costs through Distributed Energy Resource programs

6 Other

Implement security (*physical and cyber*), systems operations, emergency preparedness, and operational efficiency

The Investment Plan

The GridMod Plan will require a coordinated investment across the Government of Puerto Rico, Federal programs, and private investments.

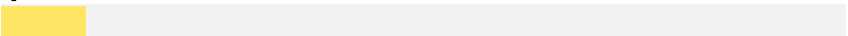
INVESTMENT STRATEGY

\$20.3 B



Total Investment

\$2 B

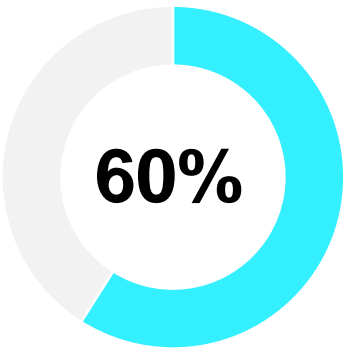


Average per Year

60%



of investments are in Transmission & Distribution (T&D)



T&D